51550

Patent Application

of

WOLFGANG HEGER

and

KLAUS FICHTER

for

WIRE CLOTH, IN PARTICULAR PAPER MAKING WIRE CLOTH

Field of the Invention

The present invention relates to wire cloth, in particular paper making wire cloth, having at least two fabric layers. The upper fabric layer is formed from making direction wires and from cross direction wires. The lower fabric layer is formed from making direction wires and from cross direction wires. For individual fabric layers, wire bridges are formed such that they do not have any binding to other wires over a definable path extension within a pattern repeat.

Background of the Invention

The dewatering of the fibrous material suspension applied to the wire cloth from above by filtration acquires major importance in papermaking processes. The fibrous material suspension is a mixture of suitable fibers, fillers, auxiliary chemical agents, and water which forms most of the mixture. In the paper industry, this filtration process is often also called sheet formation, and takes place in the wet or sheet forming part of the papermaking machine.

To be able to produce a paper sheet as uniform as possible, it is necessary to increase the proportion of water to on average 99% within the fibrous material suspension immediately before sheet formation. During the sheet forming process, this proportion is reduced to roughly 80% again

by filtration. The paper fibers, fillers and auxiliary agents remain as fiber mat on the papermaking wire cloth.

While in the past dewatering took place mainly by papermaking wire cloth on Fourdrinier paper machines, double screen machines are being used more and more often today, preferably gap formers. They are also characterized in that the fibrous material suspension is sprayed directly into the gap between the two papermaking screens, and is dewatered by the two screens. With this type of papermaking machine, the filtration process can be accelerated such that production rates of 2000 meters/min and more are possible today.

One special field within the papermaking industry is the production of sanitary paper, such as Kleenex® tissues, toilet paper, paper towels, or the like. The type of paper being used here is characterized mainly by especially low G.S.M. between 10 and 20 g/m^2 depending on the application. Graphic types of paper in comparison are between 42 and 120 g/m^2.

To form a uniform sheet with such a low G.S.M., dilution of the fibrous material suspension, which is higher than for other types of paper, is required. The concentration of fibrous material drops to approximately 0.3 to 0.5%. To be able to also effectively produce these types of paper, this larger amount of water must take place in as short a time as possible, that is to say, at the highest production speeds. At the same time, retention of the fibrous material should remain as high as possible, that is to say, only a small portion of the added fibers should be removed with water.

In the prior art (EP 0 069 101 A1, EP 0 116 945 A1, EP 0 794 283 A1, and DE 100 30 650 A1), composite fabrics are known as papermaking wire cloths. Such wire cloths have two, more or less independent, single-layer wire cloths connected to each other in different ways. For the most part, they maintain an open surface so that the high required dewatering performance is thus guaranteed. The known solutions are aimed in most instances at suitably joining a uniform paper side in the form of a two-strand fabric, also called a basket weave, to the most varied machine sides in a suitable manner. Often, decreasing fibrous material retention favors high dewatering

performance since the long wire bridges of the cross direction wires necessary for retention are not sufficiently available.

The joining of two single-layer fabrics into the papermaking wire cloth, in which longer wire bridges are formed by cross direction wires, is disclosed in EP 0 889 160 A1. The paper side (top) is implemented by a four-strand twill weave, and the machine side (bottom) is implemented by a four-strand basket weave. The two layers are joined by binding of a paper-side making direction wire to a machine-side cross direction wire. This type of fabric is characterized both by higher dewatering performance and by good fiber support based on the long wire bridges. In the known solution, currently unacceptable marking caused by the type of joining of the layers often occurs. The wear potential is limited, i.e., the machine side formed largely by the making direction wires is exposed directly to wear and, as a result, seam or wire cloth cracks can occur in use. The flexural stiffness in the transverse direction is limited due to the four-strand machine side and automatic seaming which is difficult to manage and which is caused by the lower making direction threads running parallel.

Summary of the Invention

An object of the present invention is to provide an improved the wire cloth design, while maintaining the advantages of the prior art designs, such that especially in the field of producing sanitary paper very high dewatering performance and fiber support are provided. At the same time, the fabric should be thin, but nevertheless mechanically stable against washboard marks and distortion, and should still have good flexural stiffness values in the transverse direction and ensure the possibility of advantageous seaming for joining the ends of the wire cloth.

This object is basically achieved by a wire cloth, where the wire bridges of the upper cross direction wires extend within a pattern repeat at least over nine making direction wires and at most under one making direction wire. Because the wire bridges of the lower cross direction wires within a pattern repeat extend at least under six and over at least two making direction wires, and because between two making direction wires extending over a cross direction wire at least one other making

direction wire extends under the same cross direction wire, on the upper or paper side the long wire bridges necessary for good fiber support are obtained from cross direction wires which in conjunction with the open warp ensures the required permeability for the required high dewatering performance. In addition to better fiber support, the long wire bridges act advantageously with respect to bending stability in the transverse direction of the wire cloth. The bottom or machine side, due to the double binding of the lower cross direction wires, ensures high stability with respect to diagonal distortion. Moreover, high wear resistance in the papermaking machine is achieved by the lower cross direction wires extending under at least six making direction wires.

If the wire cloth is built up preferably from plastic filaments during production or then thermofixed, the applied tension in the direction the machine runs results in that the two binding making direction wires at the binding point move toward each other. In this way, such binding making direction wires additionally enlarge the open areas of the wire cloth. Thus, on the one hand, the permeability increases and, on the other, the lower cross direction wire is more strongly bent and continues to protrude from the lower or machine side. In this way, the lower cross direction wire can be to a larger extent "ground down" in the papermaking machine. In one preferred embodiment of the wire cloth of the present invention, the top and bottom sides are formed from the same number of making direction wires, without needing to be any fixed assignment of individual making direction wires to one of the two sides. The number of cross direction wires on the top or paper side is higher than on the bottom or machine side.

The joining of the two fabric layers to each other can be effected in different ways, for example in the form of using additional binding wires made as cross direction wires or making direction wires. Another possibility of connection is integral connection using the existing wires typical of the binding, also called structure wires, such as making direction wires or cross direction wires, which can be made both as tying and also as a replacement of two adjacent wires or wire systems.

Other objects, advantages and salient features of the present invention will become apparent from the following detailed description, which, taken in conjunction with the annexed drawings, discloses preferred embodiments of the present invention.

Brief Description of the Drawings

Referring to the drawings which form a part of this disclosure and which are schematic and not to scale:

FIG. 1a is a side elevational view in section taken along line A-A of FIG. 1b and FIG. 1c of a papermaking wire cloth, according to a first exemplary embodiment of the present invention, illustrating the extension of the making direction wires and the layers being joined by replacement of the making direction wires;

FIG. 1b is a top plan view of one extract of the top or paper side of the wire cloth of FIG. 1a;

FIG. 1c is a top plan view of one extract of the lower or machine side, without the upper cross direction wires as a section between the fabric layers 1T and 1B, of the wire cloth of FIG. 1a;

FIG. 2a is a side elevational view in section taken along line B-B of FIG. 2b and FIG. 2c of a papermaking wire cloth, according to a second exemplary embodiment of the present invention, illustrating the extension of the making direction wires and the layers being joined by replacement of the making direction wires;

FIG. 2b is a top plan view of one extract of the top or paper side of the wire cloth of FIG. 2a;

FIG. 2c is a top plan view of one extract of the lower or machine side, without the upper cross direction wires as a section between the fabric layers 2T and 2B, of the wire cloth of FIG. 2a;

FIG. 3a is a side elevational view in section taken along line C-C of FIG. 3b and 3c of a papermaking wire cloth, according to a third exemplary embodiment of the present invention illustrating the extension of the making direction wires and the layers being joined by replacement of the making direction wires;

FIG. 3b is a top plan view of one extract of the top or paper side of the wire cloth of FIG. 3a;

FIG. 3c is a top plan view of one extract of the lower or machine side, without the upper cross direction wires as a section between the fabric layers 3T and 3B, of the wire cloth of FIG. 3a;

FIG. 4a is a side elevational view in section taken along line D-D of FIG. 4b and FIG. 4c of a papermaking wire cloth, according to a fourth exemplary embodiment of the present invention illustrating the extension of the cross direction wires and the layers being joined by replacement of the making direction wires;

FIG. 4b is a top plan view of one extract of the top or paper side of the wire cloth of FIG. 4a; and

FIG. 4c is a top plan view of one extract of the lower or machine side, without the upper cross direction wires as a section between the fabric layers 4T and 4B, of the wire cloth of FIG. 4a.

Detailed Description of the Invention

The wire cloth shown in FIG. 1a, 1b, 1c in the form of the papermaking wire cloth implements the fabric, according to a first exemplary embodiment of the present invention, with a ratio of cross direction wires from the top (121 to 130) to the bottom (141 to 145) of 2:1. The joining of the two fabric layers 1T and 1B is by the replacement of two directly adjacent making direction wires 101 to 110 used as a functional pair. In this connection the following making direction wires can be regarded as pairs, specifically 101, 102; 103, 104; 105, 106; 107, 108, and

109 and 110. The reference numbers having an apostrophe, that is, for example 101' instead of 101, this means that the following repeat is being addressed.

The second exemplary embodiment of the present invention shown in FIGS. 2a to 2c relates to a papermaking wire cloth described comparably to the first embodiment, by the altered configuration of the tying sites of the making direction wires 201 to 210 on the top. A modified nature of the paper side has been achieved, such that there are only few markings in the paper. In this exemplary embodiment, the ratio of the cross direction wires from the top side 121 to 130 to the bottom side 141 to 145 is 2:1. The connection of the fabric layers 2T and 2B takes place by replacement of two directly adjacent making direction wires 201 to 210 used as a functional pair. In this connection, the following making direction wires can be regarded as pairs 201, 202; 203, 204; 205, 206; 207, 208, and 209 and 210.

In the third exemplary embodiment of the present invention shown in FIG. 3a, 3b, 3c, the fabric has a ratio of cross direction wires from the top side 321 to 335 to the bottom side 341 to 350 of 3:2. The joining of the two fabric layers 3T and 3B is implemented by the tying of the upper making direction wires 301 to 305 to the lower cross direction wires 341 to 350. Here, the binding site is chosen such that it lies exactly between the binding sites of the lower making direction wires 306 to 310, and thus, is protected against wear from the bottom.

The fourth exemplary embodiment of the present invention shown in FIGS. 4a, 4b, 4c shows a fabric with a ratio of cross direction wires from the top side 441 to 455 to the bottom side 471 to 480 of 3:2. The joining of the two fabric layers 4T and 4B is by separate binding wires 461 to 465 made as a cross direction wire.

The diameter of the upper making direction wires can be equal to the diameter of the lower making direction wires. The diameter of the upper making direction wires can also be less than or equal to the diameter of the lower making direction wires. Furthermore, the diameter of the upper cross direction wires can be smaller than that of the lower cross direction wires. If